PB-216 906

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Gerald Berg, et al

Federal Water Quality Administration
Cincinnati, Ohio

1969

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VIRUSES IN WASTE, RENOVATED, AND OTHER WATERS

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Cincinnati, Ohio

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LITERATURE ABSTRACTS

VIRUSES IN WASTE, RENOVATED, AND OTHER WATERS

AWWA Committee on Viruses in Water, Committee Report. (1969). *Viruses in Water.* **J AMER WATER WORKS ASSN, 61(10):** 491–4.

This committee report presents the current status of the problem of viruses in water. It summarizes what is known about the removal of viruses by treatment processes; it discusses the virus indicator problem, and some of the current research needs.

The committee notes that water can be freed from viruses by clarification (coagulation, sedimentation, and filtration), followed by disinfection, and that disinfection can best be achieved in waters with turbidities of less than one Jackson unit. With such low turbidities, the committee believes, disinfection would likely require no more than one mg/liter of HOCl after a 30–minute holding period.

Bader, R. E. (1967). *Multiple Occurrence of Molluscum Contagiosum in the Area of a Swimming Pool. Attempt at an Epidemiological Analysis.* **ARCH HYG BAKT, 151(10):** 388–402.

From late July 1966 to early March 1967, in four neighboring communities with a total population of 733, 40 cases of molluscum contagiosum were observed among the regular visitors of a swimming pool. With the exception of two cases, only pupils were involved.

A source of infection was not found for the first cases. The severe illnesses of these first cases, and the long period of infectiousness which lasted several months, together with the conditions in the swimming pool, may have been responsible for the epidemic which reached its culmination in February 1967 with 17 new cases. Contaminated towels were probably the vehicle of transmission. Easy adhesion of the virus to the skin, whose milieu was changed by the moisture, was believed to be a major contributing factor.

Bagdasar'yan, G. A. (1968). *On the Method of Sample Collection for the Isolation of Enteroviruses from Water.* **GIG SANIT (Moskva), 33(10):** 62–3. **(Translation–HYG & SANIT, 33(10):** 71–3, 1968)

A modification of the Moore pad method for recovering viruses from water is described.

The primary processing of water samples was performed as follows. The water was transferred to sterile wide-necked jars and pads of 48 gauze layers, 10 x 10 cm, were autoclaved. The pads were attached to glass spatulas, treated with 1 ml ox serum each, and placed in jars of water. The spatula and consequently the pads, were rotated at 25–30 rpm. The duration of contact of the pads with the samples was 30–40 minutes. During this period, enteroviruses from water samples were adsorbed on pads, their adsorption facilitated by the serum proteins. The pads were transferred to sterile beakers, thoroughly squeezed, and the pH adjusted to 8 by the addition of 1 N NaOH for the desorption of adsorbed enteroviruses. The samples were transferred to sterile flasks, and stored at −20C until concentration.

Subsequently, the samples were repeatedly centrifuged at 25,000 rpm and treated with ether and antibiotics. Viruses were detected between five and six times more frequently with this method than in unconcentrated samples.

Bagdasar'yan, G. A. (1968). *Investigation of River Water for Enteroviruses.* **HYG & SANIT, 33(10)**: 134–5.

This paper presents the results of virological and bacteriological studies of water from the basin of the River Moskva. Water from Moskva, Skhodnya, and Yauza rivers was tested for cytopathic viruses from April 1965 through October 1966. Samples were concentrated by the rotating pad method, a modification of Moore's method (the pad, rotated at 25–30 rpm, was in contact with the sample for 30 minutes) followed by repeated centrifuging at 2,500 rpm and treatment with ether and antibiotics.

No relationship was found between the degree of bacterial contamination and the presence of cytopathic enteroviruses. Several times, viruses were isolated from water samples with very low concentrations of **Escherichia coli.** Most frequent isolations of cytopathic enteroviruses were made from river water during the spring–summer period. A broad spectrum of enteroviruses were isolated.

Bagdasar'yan, G. A., Zheverzheeva, V. F. (1967). *On the Problem of Application of the Method of Foam Flotation for the Concentration of Enteroviruses in Water.* **GIG SANIT, 32(9)**: 68–70. **(Translation—HYG & SANIT, 32(9)**: 396–400, 1967)

The foam flotation technic was applied to the concentration of poliovirus 1 in water samples. Experiments were performed in a glass column

25 mm in diameter and 45 cm high. A porous porcelain plate for the dispersion of air was sealed into the lower part of the column.

Addition of ox serum was necessary for virus isolation. The serum served as an adsorbent and foaming agent. Initial virus concentration ranged from 10 to 100 TCD_{50}/ml. The volume of liquid yielded by the decomposition of the foam in the foam collector was 4–6% of the volume of the sample. A 50–fold concentration of the virus resulted. Little virus was discharged in the filtrate.

Bagdasar'yan, G. A., Kazantseva. V. A. (1967). *The Isolation of Cytopathic Enteroviruses from the Sewage in Moscow and the Moscow District in 1963–1964. 2. The Efficacy of Purification of Sewage from Cytopathic Enteroviruses.* **J HYG EPIDEM, 11**: 286–91.

The presence of cytopathic enteroviruses in sewage at the main purification stages was studied at four aeration stations in Moscow and the Moscow District from February 1963 to March 1964. The plaque method was used for the isolation and assay of enteroviruses. The amounts of cytopathic enteroviruses in sewage changed with purification stages at all the aeration stations. Mechanical agitation released enteroviruses into the water and thereby relatively increased their titers. Subsequent biological treatment reduced the concentrations of enteroviruses, but did not eliminate them completely. Enterovirus concentrations in the sewage leaving the disposal plants were directly related to the enterovirus concentrations in the sewage entering the plants. Systematic virological examinations of sewage at disposal stations are an indispensable method of surveilliance over enterovirus circulation among the population.

Bennet, N. M. (1969). *Modes of Transmission of Hepatitis in Melbourne.* **MED J AUSTRALIA, 1(3)**: 510–4.

Infectious hepatitis is a major public health problem in Australia. This paper describes the results of an investigation of 421 patients with hepatitis admitted to Fairfield Hospital for Communicable Diseases from July 1964 to July 1965. The purpose of this investigation was to clarify factors concerned in the spread of this disease in Melbourne.

Bhalerao, B. B., Gadkari, S. K. (1968). *Water Supply. Problems and Solutions.* **INDIAN J PUB HEALTH, 12(4)**: 86–7. Translation presently not available.

Bondarenko, V. I., Grigoryeva, L. V.(1968). *Determination of Cytopathic Enteroviruses in Sewage of Kiev.* **MIKROBIOL ZH (Kiev), 30:** 344–7.

Investigation of Kiev sewage was conducted during 1955–1966. Water samples were taken in the Lybed River and at various purifying stages of the Bortnichi station for biological treatment.

Seventy–seven samples of 160 were cytopathic. Seventy–nine strains of echoviruses and coxsackieviruses were identified and 18 cytopathic agents were not typed.

Among the strains identified, 29 were group A and B coxsackieviruses, and 50 were echoviruses.

Echovirus 19 and coxsackievirus B4 were dominant in 1966.

Christovao, D. de A., Iaria, S. T., Candeias, J. A. (1967). *Sanitary Conditions of the Irrigation Waters of the Orchards in the Sao Paulo District. II. Isolation of Enteroviruses.* **REV SAUDE PUBLICA, 1(6):** 12–7.

Five of 11 samples of irrigation water taken from vegetable gardens of the city of S. Paulo, contained poliovirus 1, poliovirus 3, coxsackievirus A 16 and coxsackievirus A 7. The resin method rendered a higher yield than the unconcentrated samples. Isolation of enteroviruses from irrigation waters reflects the unsatisfactory sanitary condition of these waters.

Dismukes, W. E., Bisno, A. L., Katz, S., Johnson, R. F. (1969). *An Outbreak of Gastroenteritis and Infectious Hepatitis Attributed to Raw Clams.* **AMER J EPIDEM, 89(5):** 555–61.

An outbreak of 33 cases of gastroenteric illnesses of unproven etiology and four cases of infectious hepatitis occurred among 128 persons who attended a picnic in August 1966. In general, the gastroenteric illnesses developed 24 to 48 hours after the picnic, lasted one to three days, and were characterized by diarrhea, nausea, vomiting, and abdominal cramps. The illnesses were related by food histories to ingestion of raw clams **(Mercenaria mercenaria)** at the picnic. The four picnickers who developed hepatitis 22, 26, 37, and 40 days after the picnic had all eaten raw clams, and three had experienced the gastroenteric illness. Contamination of the clams probably occurred in the waters from which the clams were harvested. This outbreak of shellfish–associated gastroenteritis and hepatitis provides additional evidence that clams serve as a potential vehicle for the transmission of those diseases.

Dozanska, W., Dobrowolska, H. (1968). *Studies on the Disinfection of Enteroviruses in Sewage. II. Inactivation of Poliovirus by Combined Chlorine.* **ROCZN PANSTW ZAKL HIG, 19**: 507–15.

Inactivation of poliovirus 1 by buffered combined chlorine was studied at different pH, temperature and contact times.

Goodenough, R. D., Mills, J. F., Place, J. (1969). *Anion Exchange Resin (polybromide form) as a Source of Active Bromine for Water Disinfection.* **ENVIRON SCI & TECHN, 3(9)**: 854–6.

The polybromide form ($R^+ Br_x$) of a benzyltrimethylammonium strong-base anion exchange resin is a safe and convenient source of active bromine for water treatment. A simple semi-log relationship holds for the equilibrium distribution of bromine between water and resin phases. Elution from a packed column gives a relatively constant level of bromine in the effluent water. Anomalous effects of flow-rate on eluted bromine concentration can be ascribed to the presence of chloride in the water or in the resin. The extent of bacterial kill achieved by passing water containing **Escherichia coli** through a column of resin containing a low level of bromine was determined. The toxicology of the system is summarized, and the system's application to water treatment is outlined.

Graeser, H. J., Halff, A. H. (1969). *Discussion, Alternatives in Water Supply.* **J AMER WATER WORKS ASSN. 61(5)**: 222–4.

Author comments that transmission of viral diseases by water is currently under debate, that assessment of the ability of water treatment processes to remove infectious hepatitis virus awaits laboratory propagation of the virus, and that only limited epidemiological data are available because the impacts of water transmission are subtle both in the environment and in man.

Graybow, W. O. K. (1968). *The Virology of Waste Water Treatment.* **WATER RES, 2**: 675–701.

We are faced by population increase and industrial progress that produce an ever-growing need for potable water, and an increasing pollution of water resources.

About 100 disease-producing viruses may occur in waterways, but our knowledge about the role of water in the epidemiology and transmission of these disease agents is limited.

This literature survey shows that we do know that pathogenic viruses may survive undetected under conditions that result in the elimination of coliform organisms, that conventional sewage purification and water treatment procedures merely reduce the numbers of these viruses and that they can be isolated from water even after conventional chlorination that is regarded as satisfactory for destroying bacteria. Evidence is presented to suggest that a single tissue culture dose ($TCID_{50}$) may be sufficient to infect man if it is placed in contact with susceptible cells. Thus, although there are divergent views on the likelihood that water is an important route in the transmission of viruses, there is general agreement that water could be important as a vehicle of disease transmission. The uncertainties have to be clarified, and our water purification and disinfection methods have to be improved to ensure virus-free drinking water now and in the future.

Grigoryeva, L. V., Korchak, G. I., Bondarenko, V. I. (1968). *Sanitary-Virologic and Bacteriologic Characteristics of Sewage, Water, Mud and Soil in Suburban Zones of Kiev.* **GIG SANIT, 33(9)**: 44–8. **(Translation–HYG & SANIT, 33(9)**: 360–5, 1968.)

Findings suggest wide distribution of enteroviruses, pathogenic **Escherichia coli** and coliphage in the sewage of Kiev and their presence in sludge and irrigated soil. Enteroviruses, mainly coxsackieviruses A4, A9 and B4, and echoviruses 1, 2 and 19, were recovered from 50.9% of sewage samples examined and pathogenic **E. coli** from 2.6% of the samples. From 46 samples of sludge, three strains of enteroviruses and one strain of pathogenic **E. coli** were isolated. From 60 samples of soil, nine strains of enteroviruses were recovered. **E. coli.** and viruses survived in the sludge for 10–30 days.

Grigoryeva, L. V. (1968). *Use of Ion Exchangers for Adsorption of Viruses and Bacteria from Water.* **GIG SANIT, 33(7)**: 102–4. **(Translation–HYG & SANIT, 33(7)**: 121–3, 1968.)

Several anionic and cationic resins were tested for their ability to adsorb viruses and bacteria. Anionic resins performed better than cationic resins. Adsorption increased with decreasing grain size (increasing adsorptive area). The best results were obtained when the grain size was below 250 microns, although almost equal results were obtained when the grain size was between 250 and 500 microns. About 85% of several coxsackievirus A strains and a coliphage were adsorbed, and more than 90% of **Escherichia coli** and several other bacteria were adsorbed. Both viruses and bacteria could be eluted from the resins.

Grigoryeva, L. V. (1967). *Use of Native Ions for Isolation of Viruses and Bacteria from the Water and Soil.* **LAB DELO, 9**: 556–8. Translation presently not available.

Hamblet, F. E., Hill, W. F., Jr., Akin, E. W., Benton, W. H. (1969) *Oysters and Human Viruses: Effect of Seawater Turbidity on Poliovirus Uptake and Elimination.* **AMER J EPIDEM, 89(5)**: 562–71.

The accumulation and elimination of poliovirus by the oyster, **Crassostrea virginico,** was determined for two different turbidity levels in a flow–through seawater system. Methods used for recovering virus from seawater and oyster samples were also tested for effectiveness and plaque enumeration reliability. In the virus accumulation phase, the data indicated that oysters subjected to low turbidity seawater (16–24 ppm) accumulated in 24 hours approximately three times as much virus as those oysters subjected to high turbidity seawater (54–77 ppm). In the virus elimination phase, the data indicated that turbidity (8–80 ppm) did not significantly influence virus elimination among the four experimental oyster groups in 24 hours. In 48 hours, no virus (less than 0.2 PFU/ml) was detected in any of the oyster groups. These results provide supportive evidence that under controlled environmental conditions, oysters can effectively eliminate virus in 48 hours when they are exposed to continuously flowing seawater of either low or high turbidity.

Heintz, F., Gawlas, W., Matejova, D. (1968). *Epidemic of Pharyngoconjunctival Fever in a Youth Camp Caused by Adenovirus Type 3.* **CESK EPIDEM, 17(10)**: 321–7.

The authors describe an epidemic of pharyngoconjunctival fever, caused by adenovirus 3, among children in a pioneer camp. The epidemic affected all age groups uniformly. Several factors indicated that the epidemic was swimming–related.

Helcl, J., Novak, K., Janout, V. (1969). *Waterborne Epidemic of Infectious Hepatitis at Usti and Labem in 1965.* **J HYG EPIDEM (Praha), 13**: 201–13.

A description and analysis of an explosive epidemic of infectious hepatitis at the towns of Usti and Labem which began in the middle of April 1965, climaxed in the middle of May, and ended in the second half of June, are presented. Epidemiological investigation revealed that the infectious agent was spread by water from a part of the municipal water supply system. The

total morbidity in the part of town supplied from the contaminated water main amounted to 238 patients, or 0.71% of the population; comparative figures in the other part of the town were 29 patients and 0.075%. The highest age–specific morbidity rates were in the 10–14 and 15–19 years age groups. Males and females were affected equally.

Hill, W. F., Jr., Hamblet, F. E., Benton, W. H. (1969). *Inactivation of Poliovirus Type 1 by the Kelly–Purdy Ultraviolet Seawater Treatment Unit.* **APPL MICROBIOL, 17(1)**: 1–6.

Three experiments were conducted to determine the effect of ultraviolet (UV) radiation on poliovirus–contaminated seawater. In two experiments, the capability of the Kelly–Purdy UV Seawater Treatment Unit to inactivate poliovirus 1 suspended in continuously flowing seawater was determined. In one 99.98% of the virus was inactivated in 15.7 seconds. In another experiment, 99.94% of the virus was inactivated in 11.7 seconds. In a third experiment, a laboratory–controlled UV effort designed to simulate the geometry of the continuously flowing seawater system, 99.03% and 99.96% of the virus was inactivated in 15 and 30 seconds, respectively. A statistically significant difference was found between the inactivation rates of poliovirus 1 in the two test systems. This rate difference was attributed primarily to UV dosage and stirring effects. The authors believe that these results validate the efficacy of the Kelly–Purdy UV Seawater Treatment Unit for use in commercial depuration systems.

Hoff, J. C., Becker, R. C. (1969). *The Accumulation and Elimination of Crude and Clarified Poliovirus Suspension by Shellfish.* **AMER J EPIDEM, 90(7)**: 53–61.

The accumulation and elimination of **Escherichia coli** and poliovirus 1(LSCc2ab) by the Olympia oyster **(Ostrea lurida)**, Pacific oyster **(Crassostrea gigas)**, and Manila clam **(Tapes japonica)** were studied in a flowing seawater system. **E. coli** and crude virus preparations containing cell debris were concentrated by all three species to much higher levels than were clarified virus suspensions from which the larger particulate matter had been removed. Virus accumulation ratios (concentration in shellfish/concentration in water) ranged from 10– to 900–fold with the use of crude virus and from 0.4– to 3.6–fold with clarified virus preparations. Both crude and clarified virus preparations were eliminated by the shellfish at similar rates. Virus concentrations declined rapidly during the first 24 hours, then continued to decline more slowly. Clarified virus was usually eliminated to indetectable levels within 48 hours whereas crude virus accumulated to much higher levels.

was frequently detectable after 72 or 96 hours. The results indicate that the state in which viruses exist in natural waters, i.e., whether they are present as free particles or attached to larger particulate matter, is an important consideration in assessing the potential of shellfish for the transmission of enteroviruses.

Jopkiewicz, T., Krzeminska, K., Stachowska, Z. (1968). *Virologic Survey of Sewage in the City of Bydgoszcz. I.* **PRZEGL EPIDEM, 22**: 521–7.

Between February 1965 and January 1966, 758 sewage samples were examined for viruses. Virus isolations from persons orally vaccinated against polio were also undertaken.

From the sewage, 77 strains of poliovirus 1 (10.2%), 41 strains of poliovirus 2 (5.1%), 138 strains of other enteroviruses (18.2%), and 182 strains of reoviruses (24.0%) were isolated, and 330 samples were negative (43.5%). In 10 cases, two types of virus were discovered in the same sample. The numbers of isolated polioviruses correlated well with oral antipolio vaccinations. The numbers of other enteroviruses increased in periods between vaccinations, and suddenly decreased when polioviruses appeared in the sewage (after oral vaccination). Reoviruses occurred throughout the year irrespective of oral antipolio vaccinations. After passage through irrigation fields, polioviruses were almost entirely eliminated from sewage. Other enteroviruses and reoviruses were reduced in number, but to a lesser degree.

Karimov, Z. K., Khuriev, B. S., Basheva, V. S. (1966). *On Aquatic Outbreaks of Epidemic Hepatitis.* **ZH MIKROBIOL, 43(2)**: 142–3. Translation presently not available.

Kiseleva, L. F. (1968). *Survival of Enteric Viruses in Water and Foodstuffs and on Various Surfaces.* **HYG & SANIT, 33(9)**: 439–40.

The survival of viruses in water from various sources, in foodstuffs, and on the surfaces of household objects was studied. Water, milk, and acid dairy products were infected with viruses in doses of 10,000 TCD_{50}/ml substrate. The dose of viruses applied to glass, painted wood, cotton fabric, and bread was 10,000 TCD_{50}/0.1 ml medium.

The virulent and vaccine strains of poliovirus, echovirus 7, and coxsackievirus B3 were viable for 7 to 110 days in various water sources, for

3 to 15 days in milk, acid dairy products, and bread, and for 2 to 12 days and longer on the surfaces of painted wood, glass, and cotton fabric. The viability of the viruses outside the body was significantly affected by temperature. Survival times were longer at low temperatures, and shorter at high temperatures.

Lammers, W. T. (1968.) *Bacteriophage Populations in Natural Water.* K–1760. **US AEC UN CARB CORP NUCL DIV,** 1–20.

The application of centrifugal methods of concentrating and isolating small particles has increased the sensitivity of viral assays by approximately two orders of magnitude. With these methods, it has been possible to investigate the numbers, seasonal variations, and correlation of bacteriophage particles contained in samples of water from Poplar Creek which receives sewage from the eastern section of the city of Oak Ridge.

Samples from two locations, 6.4 km and 19.3 km downstream from the sewage effluent point of entry, were centrifugally isolated and studied. This year–long study of bacteriophage populations has given results, especially statistical correlations, which may help in assessing the behavior of these particles in water and which emphasize the importance of further investigation of natural virus populations.

Lammers, W. T. (1968). *Fractionation of Suspended and Colloidal Particles in Natural Water.* K–1749. **US AEC UN CARB CORP NUCL DIV,** 1–42.

Feasibility studies were conducted on centrifugal technics for isolating insoluble materials from samples of natural water. The isolated particulate fractions were then used in studies encompassing several areas of water pollution with particular emphasis on the characterization of different groups of isolated particles. These characterizations were confined to the physical, chemical, and biological properties of suspended and colloidal particles which influence their separation, concentration, and analysis. Systems and technics were developed for separating these materials into relatively pure particulate groups and for making reliable analytical determinations.

This report is mainly confined to a discussion of particle characterization methods and the instruments, technics and calculations used in isolating the different particulate groups for study.

Lothrop, T. L., Sproul, O. J. (1969). *High level Inactivation of Viruses in Wastewater by Chlorination.* **J WATER POLLUT CONTR FED, 41(4)**: 567–75.

Present wastewater chlorination practices (one mg/l of residual) are totally inadequate for a high level of virus inactivation. A combined chlorine residual of 28 mg/l (measured amperometrically) inactivated 99.99% T2 bacteriophage in settled raw wastewater after a 30-minute contact time. A combined chlorine residual of 40 mg/l (measured amperometrically) inactivated 99.99% of poliovirus 1 in settled wastewater after 30 minutes of contact. Free chlorine residuals of 0.2 to 0.4 mg/l completely inactivated poliovirus 1 and T2 phage in secondary effluent after 30 minutes of contact. In synthesized stormwater overflow samples, a complete inactivation of poliovirus 1 was obtained by providing a free residual of chlorine. T2 bacteriophage was much less sensitive to combined chlorine residuals than coliforms, and somewhat more sensitive than the poliovirus. The use of oxidation–reduction potential measurements as an indication of the virucidal activity of chlorine was of limited value in disinfection programs which utilized combined chlorine residuals.

The form of free chlorine used in these studies was not noted.

Lovtsevich, E. L., Sergunina, L. A. (1968). *Disinfection of Drinking Water Containing Enteroviruses by Products of Sodium Chloride Electrolysis.* **GIG SANIT, 33(9)**: 22–6. **(Translation—HYG & SANIT, 33(9)**: 334–41, 1968.)

A study was undertaken of the dynamics of inactivation of virulent and attenuated poliovirus strains, coxsackieviruses B3 and A7, **Escherichia coli,** and coliphage by the products of NaCl electrolysis in tap water. Inactivation proceeded more rapidly at pH 7.3 than at pH 8.3. Gaseous chlorine produced similar results. **E. coli** was less resistant than the phage, and the phage was less resistant than the enteroviruses to the electrolysis products.

Mats, L. I., Korsh, L. E. (1967). *On the Circulation of Pathogenic Microorganisms and Viruses in the Soil, Water, and Air.* **GIG SANIT, 32(9)**: 84–7. **(Translation—HYG & SANIT, 32(9)**: 415–8, 1967.)

Current literature, primarily Russian, on the survival of certain viruses and bacteria in water, soil, and air is reviewed. The author concludes that the fairly prolonged survival of pathogenic microorganisms and viruses in soil, water, and air make their prolonged circulation in the external environment possible and constitute an epidemiological danger to the human population.

Nineteen references are cited.

Mitchell, R., Jannasch, H. W. (1969). *Processes Controlling Virus Inactivation in Seawater.* **ENVIRON SCI & TECHN, 3(10)**: 941–3.

The rate and extent of inactivation of a bacteriophage in natural seawater was controlled simultaneously by biological and abiological factors. A specific antagonistic group of microorganisms developed when the phage was added to seawater. In addition, a direct chemical inactivation was detected in filter-sterilized seawater. A protective effect for the survival of the phage was shown to be related to the presence of microbial cells killed either by autoclaving or by ultraviolet irradiation. In natural seawater, the combined action of biological and chemical antiviral activities is believed to be substantially stronger than the protective effect exerted by the detrital organic material.

Nikolaevskaya, Z. S., Kalina, G. P., Vinogradova, L. A., Aizen, M. S. (1969). *A Comparative Evaluation of the Resistance of Several Enteroviruses and Sanitary Indicator Microorganisms to the Effect of Active Chlorine.* **ZH MIKROBIOL, 46(2)**: 54–6.

Attenuated strains of poliovirus were more resistant to chlorine than virulent strains. Both virulent and attenuated strains of poliovirus were more resistant to chlorine than **Escherichia coli.** Chlorine resistance of enterococci exceeded that of the virulent strains of poliovirus, being practically equal to that of the attenuated virus. Chlorine resistance of enterococci was much greater than that of **E. coli.**

Rao, N. U., Labzoffsky, N. A. (1969). *A Simple Method for the Detection of Low Concentration of Viruses in Large Volumes of Water by the Membrane Filter Technique.* **CANAD J MICROBIOL, 15(5)**: 399–403.

A simple prefilter pad membrane filter combination method is described for the detection and quantitation of low concentrations of virus in natural waters. The data obtained indicate that in surface water experimentally contaminated with poliovirus (Mahoney), more than 50% of the virus was recovered. It was demonstrated that the prefilter pad (AP25), when used by itself will adsorb viruses. A certain concentration of electrolytes (200 ppm Ca^{++}) in water was necessary to prevent the loss of virus when filtering was done through the membrane filter.

Ratzan, K. R., Bryan, J. A., Krackow, J., Meyer. G., Larson, C.D. (1969). *An Outbreak of Gastroenteritis Associated with Ingestion of Raw Clams.* **J INFECT DIS, 120(8)**: 265–8.

An outbreak of non-bacterial gastroenteritis resulting from the ingestion of raw clams is described. The clams had been obtained from a bed contaminated by raw sewage a few days prior to the harvest. Seventeen of 19 people ingesting the clams became ill. The secondary attack rate was about 37%. Most of the ill received immune serum globulin. No clinical hepatitis developed and SGOT determinations were repeatedly negative indicating that no hepatitis infections had occured.

Ruddy, S. J., Johnson, R. F., Mosley, J. W., Atwater, J. B., Rossetti, M. A., Hart, J. C. (1969). *An Epidemic of Clam-Associated Hepatitis.* **J AMER MED ASSOC, 208(4)**: 649–55.

During a 32-week period from November 1963 through June 1964, an epidemic of 123 cases of viral hepatitis following ingestion of raw clams occurred in Connecticut. Several observations supported the incrimination of raw clams as the vehicle: a high proportion of cases among adult males, a low proportion of patients having history of contact with a previous case, the occurrence of cases in two epidemic waves, the similarity between the known incubation period of infectious hepatitis and the intervals from consumption of raw clams to onset of illness, and results of a survey which indicated that more than six times as many hepatitis patients had eaten raw clams as had persons without hepatitis. The clams probably came through the regular commercial channels from several suppliers, but their harvesting waters could not be identified.

Singh, M. P., Hermodsson, S., Edebo, L. (1969). *Virucidal Effect of Transient Electric Arcs in Aqueous Systems.* **APPL MICROBIOL, 17(1)**: 54–8.

Bacterial and animal viruses were inactivated by high voltage electrical discharges in water. The sensitivity of phages to the immediate component of this effect was correlated to sensitivity to ultraviolet radiation. Transient electrical arcs in weak electrolytes also generated chemical compounds which were virucidal against several different phages. These compounds were only slightly virucidal against phages T2 and T4.

Sokolovski, B. (1969). *Significance of the Presence of Free Dysenteric Phage in the Water.* **VOJNOSANIT PREGL, 26(3)**: 124–7. Translation presently not available.

Soloslovnikov, I. U. P., Padalkin, V. P., Balandinskaia, I. V. (1967). *Water–borne and Food–borne Outbreaks of Epidemic Hepatitis (Review of the Foreign Literature).* **ZH MIKROBIOL, 44(12):** 68–72. Translation presently not available.

Stachowska, Z., Krzeminska, K. (1968). *Reoviruses Isolated from Sewage in the City of Bydgoszcz Between February 6, 1965 and January 28, 1966. II.* **PRZEGL EPIDEM, 22:** 529–32.

Data from the literature pertaining to reoviruses are discussed, and results of examination of sewage in the city of Bydgoszcz for these viruses are reported. A total of 182 reovirus strains were isolated.

Thomas, W. C., Jr., Black, A. P., Freund, G., Kinman, R. N. (1969). *Iodine Disinfection of Water.* **ARCH ENVIRON HEALTH, 19(7):** 124.

Until recently, disinfection of water with iodine was limited largely to emergency situations. This halogen is now used with increasing frequency as a disinfectant for swimming pools. Observations on 22 individuals using an iodinated pool for one month revealed that they did not absorb sufficient iodide to modify either the radioactive iodine (RAI) uptakes or serum concentrations of protein–bound iodine (PBI).

A five–year feasibility study of the use of iodine for disinfection of a community water supply has been conducted. Effective bacteriological control was obtained with 1 mg of iodine per liter of water. Assessment of thyroid function of representative users of this water supply revealed the expected decrease in thyroidal uptake of iodine 131 (I^{131}) with no change in serum thyroxine values.

Vakhidov, N. M. (1968). *Isolation of Poliovirus and Various Other Enteroviruses from the Sewage of the City of Dushambe.* **GIG SANIT, 33(11):** 103. **(Translation–HYG & SANIT, 33(11):** 287, 1968.)

Material for the virological investigation of sewage was collected by Moore's pad technic. The 210 sewage samples tested yielded 72 strains of enteroviruses. The most abundant yield was obtained in 1964, but in 1965 it diminished by 1/2 to 2/3. The 1964 material yielded five strains of poliovirus, but in 1965 the virus was not isolated. Apparently the circulation of poliovirus in the external environment was reduced by regular revaccinations with live poliovirus vaccine.

Viera, R. M. (1967). *On Bacteriophages Found in the Caribbean Sea.* **MIKROBIOLOGIIA, 36(7–8)**: 713–6.

Thirty samples of sea water taken from the Caribbean Sea near the Venezuela coast at 50 meters, and four and six nautical miles from the beach were tested for bacteriophages.

Bacteriophages were found in six samples of sea water, five taken 50 meters out, and one taken four miles from the beach.

The phages infected all tested Salmonella and Shigella cultures, and almost all tested cultures of **Escherichia coli** and **Proteus vulgaris.** No bacteriophages active against 11 bacterial strains isolated from the same samples of sea water have been found.

Wiza, J., Mazur, B., Bogaczynska, E. (1968). *Studies of River Water, Sewage, and Water Supply in the City of Poznan for Presence of Cytopathic Viruses.* **PRZEGL EPIDEM, 22**: 533–7.

Between February 1965 and June 1967, 127 samples of sewage, 202 samples of water from the Warta River, and 362 samples of main water were examined for cytopathic viruses.

Viruses were recovered from 25.2% of the sewage samples, and from 6.9% of the river water samples. No virus was isolated from main water.

Yakovleva, G. P., Il'Nitskii, A. P. (1967). *On the Problem of the Ozone Disinfection of Water Containing Drug Resistant Forms of Dysentery Bacteria and Adenoviruses.* **GIG SANIT, 32(12)**: 17–9. **(Translation–HYG & SANIT, 32(12)**: 330–3, 1967.)

Comparative resistance to ozone of drug resistant strains of **Shigella flexner** 1402 and New Castle 687 and that of **Escherichia coli** 685 was studied. The efficiency of ozone disinfection of drug resistant dysentery strains and coliforms in water was determined. A study of the effect of bacterial contamination and temperature on the ozone disinfection of adenoviruses in water was undertaken also.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

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